THE INDIVIDUAL VERSUS THE COMPUTER: AN EXAMINATION OF ATTITUDE PROBLEMS AND THEIR IMPACT ON SYSTEM DEVELOPMENT

Gayle Jean Plato

NAVAL POSTGRADUATE SCHOOL
Monterey, California

THESIS

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by

Gayle Jean Plato

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by

Gayle Jean Plato
Lieutenant, United States Navy
B.A., University of California, Berkeley, 1973

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ABSTRACT

Whether rational or irrational in nature, negative feelings toward computer based systems have been a persistent problem for computer implementors and systems managers for many years. People may sometimes fear for the future of their employment, feel intimidated by a technology they do not understand, resent the invasion of privacy associated with indiscriminate data collection, or exhibit a wide variety of other emotional responses.

In order to better anticipate, understand and cope with the multitude of emotional reactions and interface problems that potentially may develop among non-technical computer system users, current literature pertaining to such negative attitudes has been explored. With a greater understanding of possible human-computer interface problems, it is believed that managers, computer professionals, system users and social institutions alike can all assume important roles in helping to promote more universally positive interactions and attitudes in the future.

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I. INTRODUCTION

Almost since its inception, the introduction of computers into modern society has been accompanied by a variety of negative responses by those who feel their lives are somehow adversely affected. Although seemingly an innocuous technology aimed at helping rather than hindering mankind, computers have been viewed by some as posing personal, economic, social and ethical threats to both individuals and society as a whole. As a consequence, emotional reactions have been evoked that range anywhere from mild nervousness or anxiety to extreme fear, indignation and even hostility directed toward computer technology - its products, its developers, and its proponents.

In an attempt to better understand the types of emotional reactions and attitude problems that can evolve among non-technical computer system users, this thesis examines some of the more prevalent attitude problems associated with computerization. It is hoped that by exploring the types and causes of negative feelings, whether rational or irrational in nature, more positive steps might be taken to retard their formation in the future.

II. HISTORICAL PERSPECTIVE

In the early years of computer technology, system efficiency was the primary goal of computer professionals. System development projects were considered to be mostly technical in nature, and therefore were almost totally turned over to technically trained computer personnel [Ref. 1]. They concentrated most of their efforts on technical issues and generally ignored human matters. A plausible explanation for this neglect is that each computer of the time was designed as one of a kind; they were very expensive to build and operate, and machine time was far more expensive than the human time required to program or operate the machine [Ref. 2].

The early information systems that were developed were generally small, localized, and tended to generate curiosity because of their technical novelty [Ref. 3]. However, until about 1950, most workers and their representative trade unions were generally indifferent about the advent of computers [Ref. 4]. Not forseeing the computer's potential and widespread impact, this apathy is understandable. But, as Dallinger aptly observes, this lack of concern "changed suddenly with the spectacular qualitative and quantitative

development: automation now became synonymous with anxiety and fear."

History has shown time and again that because very little consideration was given to the needs of the user or the environment in which the system was to be operating, many technically successful computer projects were cumbersome and difficult for people to use [Ref. 5]. However, as computer systems became more and more widespread in use, the behavioral aspects associated with their introduction into organizations gradually became more important [Ref. 6]. Unfortunately, this concern has often been shcwn only after the many system failures that resulted because such issues had originally been dismissed as irrelevant.

The concern for humanizing the design and application of computer systems is actually a fairly recent phenomenon. Just a little over a decade ago a prestigious conference on personnel research addressed this issue, and concluded that:

> "...if computer science is to become socially responsive, it needs to become thoroughly humanized - which means the scientific study of the human use of computers - an orientation...that is nowhere on the computer horizon today." [Ref. 7]

E. Mumford and T.B. Ward (1968) and T.I. Whisler's (1970) studies of the impact of introducing computers into organizations provided some of the earliest applications of

the behavioral perspective in Manangement Information Systems (MIS) implementation [Ref. 8]. However, Keen has claimed that there has been little in the way of follow up studies, partly because there persists a general sense that MIS issues are primarily technical. Further, despite behavioral issues, computers have continued to be introduced into organizations' operation because they are both "benefical and inevitable."

Human problems exist at both the hardware and software interface levels. While this thesis focuses primarily on software interface issues, hardware problems are often so integral an aspect that they must be concurrently addressed. In a 1975 article, it was noted, with regret, that:

> "...computer manufacturers have not devoted resources to researching the human factors on the computer systems leased and sold to customers. Millions of dollars are allocated to the research and development of computer technology, and massive industry efforts are devoted to solving technical challenges ... (but this) neglect of the human factors remains one of the fissures in the foundation of the computer industry." [Ref. 9]

Even the so-called "giant" in the computer field can be found guilty of neglecting human issues in the development of what was, in its time, the most successful computer operating system - OS/360. It has been criticized that for most computer programmers - who are themselves technicians - OS/360 was "complex, labyrinthian, infuriating, clumsy, and

perilous to use." [Ref. 10] Initial ignorance of human engineering issues by the designers who built the operating system from a strictly technical perspective is cited as the reason programmers encountered so much trouble in using it.

Still, although there is not a great wealth of knowledge in the subject area, people have undertaken various means to study the problem - especially within the last decade - and produced a fair amount of literature as a result. "The Human Problems of Computer Introduction" [Ref. 11], published in 1972, presented an early methodology for systematically catering to the human needs when introducing computer systems into an organization. It examined the "fit" between organizational requirements for employees and what employees, in turn, require from the organization. In recognizing the over concentration on technical variables and the almost total neglect of human variables in the planning, designing, and implementing of computer systems, the authors proposed a basis for a socio-technical system design. This design methodology was intended to help computer specialists, personnel managers and line managers in systematically thinking through the human elements concerned with computer introduction. The "success" of the computer system was to be evaluated both in terms of technical merits and a human point of view.

Mason and Mitroff [Ref. 12] offered some very insightful contributions in recommending research methodologies for Management Information Systems back in 1973. Providing their classic definition of an information system as consisting of

> "at least one PERSON of a certain PSYCHOLOGICAL TYPE who faces a PROBLEM within some ORGANIZATIONAL CONTEXT for which he needs EVIDENCE to arrive at a solution (i.e., to select some courses of action) and that the evidence is made available to him through some MODE OF PRESENTATION" [Ref. 13],

the authors proposed that a program of research on MIS should seek to explore MIS in light of systematically varying each of the variables capitalized above. They recognized two very important principles in their work - (1) that managers require information geared to <u>their</u> psychology and <u>not</u> to that of the system designers, and (2) that managers must have a way of generating evidence that is geared to <u>their</u> problems and <u>not</u> to those of the system designers.

Unfortunately, recognizing the need for better understanding of the many influential "human variables" contributing to the success of a computer system and actually employing them are two distinctly different activities. As this thesis explores some of the more common problems surrounding negative attitudes and emotional

responses to the current state of computer technology, it becomes apparent that there is still much we need to understand about the human-computer interface and how best to avoid the pitfalls of the past.

III. COMPUTER RELATED ATTITUDE PROBLEMS

When computer based systems are introduced (or even proposed to be introduced) into an organization, a wide variety of feelings, emotions and attitudes may develop among the employees who are destined to use the system. This chapter will describe some of the more commonly encountered human reactions to "computerization" in order to establish a basis for further examination of the many problems that result from negative attitudes toward automation.

It is recognized that the attitudes described may, in some cases, be directly attributable to a particular individual personality problem rather than being a rational reaction to a faulty or poorly implemented system. But the attitudes are real - regardless of origin - and must be dealt with in some manner. It is further recognized that many of the problem areas presented are highly interrelated or similar in nature, and in their cause and effect, so that to consider each in isolation of the others may not always be appropriate. However, for ease of presentation, they have been collected and catagorized under generally related areas.

A. EMPLOYMENT ANXIETY

A great deal of anxiety regarding future employment has been brought about by the advent of modern computers and by automatic process control in industry [Ref. 14]. As far back as 1950, Norbert Wiener was predicting "the possible end to full employment and the obsolescence of all but a small fraction of the work force because of computers." [Ref. 15] The argument was based on the assumption that if entire processes can be fully automated, productivity will improve significantly and only a few people will be required to maintain and monitor the equipment. Fortunately, as the authors observe, this prediction has not come true, but computers still have resulted in serious job displacements in some circumstances. As a consequence, computerization seems to carry somewhat of a stigma relating to employment. Understandably, people often fear for the future of their jobs or their promotion opportunity when automation "invades" their organization.

Although workers may believe that computers allow their performance to be more easily judged by superiors, several studies have found that clerical workers associated with automation frequently feel that their promotion chances have decreased because of the decline in the number of middle

steps in the promotion ladder [Ref. 16]. Additionally, they feel promotion into the higher level jobs for computing is out of their reach since selection for such jobs is viewed to be based on training and aptitude, and not just experience in the lower levels. So, as the authors observe, "while workers may tend to believe that the system is fair, they may simultaneously be resigned to limited upward mobility, and hence experience a higher level of normlessness." [Ref. 17]

Members of the more specialized professions (such as scientists, engineers and technological managers), often express a concern over becoming "obsolete" [Ref. 18]. Computers have accounted for significant advances in many of the technical fields in recent years, and individuals who do not keep up with all the recent advances in their fields (including the utility of computers, in particular) tend to become incompetent at a level at which they once performed at least adequately. Older workers are noted as being particularly vulnerable to this problem. Consequently, management tends to view the younger employees more favorably and reward them with better performance ratings, more challenging work assignments, and more salary increases.

Even among the more scholarly members of our society, the computer may still represent a threat to job security. Although it may not be as prevalent a sentiment in today's universities, a few years back it was observed that "a significant number of faculty members in most of our schools have an extreme distaste or even fear of the computer." [Ref. 19] This feeling is partly attributable to the fact that the computer, in creating new demands for skills, was causing the universities to split among technically-oriented and humanities-oriented components. The result was increased internal stress among faculty members.

B. DEPERSONALIZATION AND DEHUMANIZATION

Strong criticisms can frequently be found against computer based systems that tend to dehumanize work, depersonalize the individual, or degrade the overall quality of life. In "Humanizing Information Systems" [Ref. 20], Sterling and Laudon describe several such trends which they feel have served to "dehumanize" the individual. For example, bureaucratic systems which reduce the individual's opportunities to negotiate or communicate with the bureaucracy; the decline in the ability of systems to fulfill an intended service or function; the obscuring of where authority for decisions actually exists; and the

exploitation of lower level workers and end users who have to work harder because of poorly designed automated systems are among their stronger criticisms of ways in which current technology can, and often has, affected people.

Complaints of "depersonalization" via the use of computers have also been heard for a long time. Many people object to having their identities reduced to a mere series of numbers and stored in 'bits and bytes' on a cold, unfeeling machine. One writer has noted that:

> "It probably is no accident that, during the first of the major campus riots at Berkeley, resentment was directed to the punch cards and computers that students claimed made them feel more like numbers than like people." [Ref. 21]

A strong objection to automated systems can additionally be found among users who feel they should not have to adjust <u>their</u> established procedures to suit the needs of the computer. As Martin [Ref. 22] notes, the high degree of standardization needed to use computers efficiently can be attributed to causing this sense of depersonalization. Hiltz and Turoff [Ref. 23] refer to this as the "Concrete Effect," noting that very often users come to feel that they must adapt to the ways of the computer rather than adhering to an individually preferred way.

Middle level managers have often been known to express the view that the computer interface is too restrictive.

They may feel that the computer limits their alternatives for action, and thereby their opportunities for effective, satisfying performance [Ref. 24]. This sentiment is especially strong among the occasional users of computers. One study found that managers and specialists were much less tolerant of poor systems than were clerks who were required to interface with computers on a regular basis [Ref. 25]. They felt that the computer should serve as a tool which fitted their needs, not that they should have to modify their own behavior to suit the computer's requirements. The study found this feeling led to one of three responses by the dissatisfied users: (1) they would not use the system at all, (2) they would make only limited use of it, or (3) they would use a human intermediary to operate the terminal for them.

The reluctance managers may feel toward using a computer terminal <u>themselves</u> is particularly interesting. As was noted above, in many cases a tendancy has been observed among managers to have a subordinate act as a "human" interface to operate the terminal on the manager's behalf [Ref. 26]. Whether the excuse is not being able to type or not having the time to devote to learning or operating the terminal, one cannot help but suspect that at least part of

the underlying cause for this widespread disuse is that the managers do not feel sitting down at a keyboard is "appropriate" for someone of their position. Rather than suffer the "degradation," they find someone else to operate the terminal for them, and can thus still enjoy the benefits of the system.

The computer as a communications media has also been criticized for being too "impersonal" by those who prefer direct human interaction [Ref. 27]. In a study conducted to observe how managers utilized a computer based message system (CBMS), it was found that, although there were overwhelming advantages to the system as a whole, there were also serious problems relating to the impersonal nature of the computer [Ref. 28]. Because non-verbal aspects of speech (e.g., intonations of voice, facial expressions, laughing, etc.) were lost, many misunderstandings resulted when people did not comprehend intended meanings of messages transmitted over the CBMS. Phone calls or other personal contact were often required to clear up such misunderstandings. Consequently, it is understandable that some people may be apprehensive over using a system with which they are not completely comfortable - or certain that their communications will be accurately construed.

C. COMPUTER VIEWED AS A "TOOL OF POWER"

The view that "information is power" has become widely accepted in our society, and with it follows the realization that "power devolves upon those who gather, process, disseminate, or simply possess information." [Ref. 29] With the potential to change bases of power and create new ones with this "information commodity," it is not surprising that the introduction of computers into an organization can have significant affects on the relationships between and among different organizational components and individuals involved.

Although probably not a majority view, there are those who regard the computer as posing a real threat to our society. In just one of numerous articles written to date that explores the social implications of computer technology, the authors of "The People's Computer, an Aid to Participatory Democracy" refer to the computer as "becoming a repressive instrument in the hands of big government and corporations." Further, they adamantly stress the need to "provide the common man with easy access to computer facilities to even up the social, economic, and political balance of power." [Ref. 30]

Another expressed fear is that the social balance of power has been altered because a few technocrats have taken over the function of social planning, and that these people - although technically qualified - may lack the necessary experience in dealing with people [Ref. 31]. While these types of social, political, and philosophical issues may be interesting to examine, any further comment would be beyond the scope of this thesis. However, the point should not be overlooked that, clearly, opinions of this nature reflect definite feelings, attitudes, and anxieties of those who expound their opinions, and therefore such feelings must be dealt with in terms of human-computer interface issues.

D. LOSS OF POWER AND REDUCED SENSE OF ESSENTIALITY

Computers - and especially management information systems - can also be view as invaders of the "power realm" previously dominated by managers. As a result, managers may come to feel less powerful and less essential to the organization.

The feelings of loss of power or control may be attributable to several different aspects of automation. For example, Argyris [Ref. 32] has noted that "an effective MIS will ask the executives to produce precisely that information that they may have learned to withhold (until

the appropriate moment) in order to survive." Consequently, those executives who enjoyed the feelings of power and freedom to manipulate information as they saw fit will understandably resent a "machine" that demands all relevant data to be entered for public view and manipulation by the system algorithms.

Similarly, executives may feel their ability to take credit for successful decisions is significantly reduced by the presence of an effective MIS. Tomeski [Ref. 33] has noted that all the publicity about the power and potential of the computer as an "indispensable tool" can certainly cause feelings of inadequacy. Further, with more activities being carried out in a planned and rational way by the MIS, people may feel that credit more appropriately lies with the computer rather than with the manager. Argyris explains that:

> "success, in the past, may have come from selecting an admittedly ambiguous course of action but, with resources and power, making it come to reality. The manager, therefore, had good reason to feel essential and powerful. If a decision was successful, he could point to where his influence was important." [Ref. 34]*

An American Management Association research associate has also summed up this sentiment in the following:

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*Of course, it has also been said that the MIS (and its designers) could be used as a convenient scapegoat, but this is not typically the case because executives usually do not like to employ a strategy of blaming others.

> "With the introduction of computers and the expanding automation of the management functions, executives feel cheated out of their traditional satisfactions. They're no longer decision-makers. They feel like spokes in a wheel." [Ref. 35]

A sense of "psychological failure," as Argyris [Ref. 36] and others have discussed, can occur when individuals perceive that someone - or <u>something</u> - else is defining their goals, providing the path to their goals, defining their level of aspiration and establishing their criteria for success. As management information systems take over or assist in more and more of the traditional management domains, they also present the potential for causing this sense of psychological failure in the managers who must deal with them. Managers who aspire toward challenging and responsible work, but who also feel the MIS imposes too heavily on their territory for decision making, may decide to leave the organization, fight the system, or remain with the organization but psychologically withdraw. Obviously none of these reactions are favorable responses to a system that is only intended as a tool to help the managers make better decisions and help them in the performance of their overall duties.

As organizational functions are more explicitly defined by the introduction of automated systems, management's ability to control through easily available access to

information is also greatly enhanced. This can result in what Argyris [Ref. 37] calls a feeling of being increasingly "hemmed-in." In psychological terms, he explains that this can cause people to experience a great restriction of their space of free movement, which consequently tends to create feelings of lack of choice, pressure and psychological failure. All of these feelings can add up to more feelings of helplessness and less feelings of self responsibility which, in turn, can cause increased tendencies to withdraw or to become dependent upon those who caused the restriction of their space of free movement.

E. INVASION OF PRIVACY

To many the advent of computers is associated with visions of mass invasion of privacy. Thanks to advanced computer technology, all sorts of information about individuals is readily available, and the potential for invasion of privacy is quicker, more effective, and more comprehensive than was ever before possible [Ref. 38]. It is no wonder, then, that many people may form prejudices against these suspicious "snoops" who may know more about their private lives than they care to have recorded. Even when people are faced with so-called successful management information systems, many still express reservations because

they are uncomfortable about the general "encroachment of computers and associated technology on our daily lives." [Ref. 39]

Organizations which switch over from manual to automated systems may view the computerization as somewhat of an invasion of privacy or threat because the transition can reveal those aspects of a job or organization that were previously undocumented. It has been observed [Ref. 40] that the system designer may surface behavior, policies, practices and norms that have been operating covertly - an uncovering which could prove threatening or incriminating to the participants. An example of such a situation might be a bank that routinely denies loans to certain groups of people (say, women and minorities), but whose "policy" is not written down and is thus left to the "discretion" of the loan official. However, if the bank chose to automate the loan evaluation process, such discriminatory procedures would quickly become apparent in the system algorithms to evaluate and grant loan requests.

F. FEELING CONTROLLED AND MONITORED BY THE COMPUTER

Objections expressed in terms of being controlled, monitored, or manipulated by computers are often found. For example, one study found that clerks who were largely

involved with short cycle, repetitive computer operations (especially data input) complained most often of excessive routine, limited job satisfaction, and of being controlled by the computer [Ref. 41]. Similarly, managers anticipate that the automated information systems that increase the amount and complexity of information available for use will afford new opportunities for controls and checks on their performance. A mid level manager sums up this attitude as follows:

> "I foresee more and more control systems being introduced, creating greater centralization of controls and in the responsibility for decisions on a day-to-day basis; this making the manager in the field a 'robot' but responsible for his actions." [Ref. 42]

It has also been observed that if a user feels a loss of control - that the computer is taking over or that processing logic is not sound - productivity will be decreased and errors will increase [Ref. 43]. It is, of course, understandable how such feelings could develop in a worker - especially one is accustomed to a manual system and has never directly worked with a computer. When a user has no understanding of the underlying algorithms of the programs with which he must interface, when he has lost his local access to hard-copy records, when he is remote from the computer processing, and when he possesses no means of

manual override for the system with which he is associated, how could he help but feel "controlled" by the computer?

An anxiety derived from a feeling of being "monitored" or "evaluated" by a computer can certainly have negative effects. When coupled with the added anxiety of job insecurity (e.g., when a job is dependent upon how well one can work with a computer based system), it has been found that feelings of being evaluated by a computer can result in a high error rate for the user [Ref. 44].

Suspicion toward the "controlling power" of systems has been observed at many levels. In an experiment designed to observe verbal reactions toward a computer, Scheibe and Erwin [Ref. 45] recorded a subject exclaiming during a game session with the computer: "Does it record my patterns from the other games so that it knows what I do? I bet it does. I bet it knows what goes on in my head." Obviously the subject did not really believe the computer was "tapping" his brain, but the reference to being monitored could indicate an underlying suspicion toward computers in general. Many information systems do record previous interactions for analysis, a situation which could cause some people to wonder exactly <u>what</u> is the machine doing with all the information they are supplying. (Is it reporting

back to their superiors? Is it comparing their input and error rate with those of their peers?) These cannot be considered unrealistic concerns.

G. INTIMIDATION AND CONFUSION

Working with a computer based system can be very intimidating and confusing to some people. Both the mechanics of the system and the computer staff interface can often be (at least partially) faulted with causing these feelings.

It has been observed that too often people feel a sense of futility, fear and harassment when interacting with a computer system because of its tireless, persistent, and rapid operation and its unsympathetic, impersonal, and objective nature [Ref. 46]. Hiltz and Turoff have aptly named this type of intimidation the "Bully Effect" [Ref. 47]. They note that the rapid response of a terminal and sometimes even the wording of questions makes the user feel that a fast response is required. Similarly, they criticize billing schemes that charge a user according to the time a terminal is turned on as leaving the impression that a person's "think" time is costly.

In another type of intimidation they call "Computer Angst," Hiltz and Turoff [Ref. 48] explain that a fear of

breaking the machine is often a very real fear among users. Warnings such as "In no circumstances are you to use the following keys" are blamed for reinforcing such fears. Additionally, somewhat pompous salesmen and computer professionals who take the attitude that the user cannot comprehend the complexity of the system serve to perpetuate this intimidation in many instances.

Computer "jargon" is another notorious cause of intimidation and confusion. Computer people are frequently ridiculed for their propensity toward using this baffling "computerese" around uninitiated users. In an amusing, half-serious/half-humorous text entitled The Computer Survival Handbook, Wooldridge and London caution that:

> "Half the battle of understanding computers - and more important, computer people - is to understand the jargon. If you really want to come to terms with them, you will have to understand their in-jokes and their pompous way of talking ... (but) you must be careful not to use an out-of-date term or mispell a technical word; it immediately identifies you as a gauche outsider who is trying just a little too hard..." [Ref. 49]

Tomeski has observed that ignorance about computers and their use is a major cause of negative attitudes:

> "To a large number of people, the computer remains a mysterious and threatening device. The computer is viewed as a composite of demonic and godly characteristics and capabilities, as can be seen from the generic terms used in referring to the computer: the giant brain, the monster, the robot, the black box, and some unprintable adjectives." [Ref. 50]

He notes that this ignorance is reflected in a variety of

ways - from a blanket indictment against all computers as being ineffectual and the cause of all organizational shortcomings to the fear that computers are so powerful that they will soon seize control of the world.

H. SYSTEM VIEWED AS INEFFECTIVE AND INEFFICIENT

When a system user believes that the work required to utilize a so-called labor-saving device is excessive compared with the benefits reaped, it is obvious that the work will be less than enthusiastically undertaken. Whether it is a poorly conceived or badly implemented system that does, in fact, require excessive effort, or whether it is actually a good system that is just not understood by the disgruntled user, the net result is the same - the user's attitude toward the computer is negative.

Information overload is one of the more common complaints of computer users. In a study of mid-level managers, Guthrie [Ref. 51] found many managers to be concerned about the "information deluge." They overwhelmingly complained of too much, unrelated, unhighlighted data being presented to them. Rather than being assisted by pertinent data, they felt this information overload was both a barrier to proper decision making and a burden to them in attempting to perform their proper

functions. Representative of the type of comments made by these managers is the following:

> "The volume of information of all kinds supplied to management at all levels far exceeds the needs for effective and efficient controls. As a matter of fact, so much time is devoted to obtaining information that the proportion of man-hours left for essential functions is being progressively reduced. In other words, information is no longer an instrument of efficiency but a contributory cause of inefficiency."

Attitudes such as this obviously do not reflect appreciation for the system or enthusiastic acceptance on the part of the user!

I. INCREASED VULNERABILITY

Feelings of increased vulnerability often surround automated systems - and frequently for good reason. Computerization not only brings with it more opportunities for fraud, sabotage, and industrial espionage, but also complicates a variety of reliability problems.

In "Management, the Computer, and Society" [Ref. 52], Martin Ernst discusses the many issues surrounding computer vulnerability, and suspects that we have not even begun to see the extent to which fraud can take place through the use of computers. The many publicized instances of companies' computer systems being subverted or sabotaged by clever, but dishonest intruders is reason enough for people to be wary of the potential for trouble with their computers.

Reliability problems are also a great cause for concern among people when they have important systems that depend upon computers. From the small, independent company that relies on a computer to generate monthly billing statements to our computer-based national defense and multi-billion dollar space systems*, the consequences of a computer failure can be anywhere from inconvenient and costly to devastating!

J. ISOLATION

Computer based system users often feel somewhat deserted or isolated in their interactions with the computer or because of the computer. People who work with computer terminals have expressed such complaints when they sense no one is available to help them along in their work. When a question of machine capability comes to mind or an operational problem arises, there is often no one to whom they can turn for immediate answers. Studies have found an overall need for user support to assist in computer related matters - not just during the system implementation phase - but as an ongoing concern. However, since such groups often

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*Recent isolated cases of problems with such systems as the World Wide Military Command and Control System (WWMCCS) and the delay in the launching of the Space Shuttle Columbia provide vivid evidence of the kinds of public reactions that result when crucial systems fail.

do not exist in organizations, users are left to rely on other users for the help and guidance they require [Ref. 53]. Unfortunately, fear of going to other users is another attitude problem - called "People Angst" [Ref. 54] - that has been described in the literature. When users are both afraid to ask questions of other users, and there are no computer staff members around from whom to seek "expert" help, it is no wonder that feelings of isolation can result.

Additionally, the introduction of a computer based system can often disturb the social structure of the work environment in which it is introduced. In Computers: Planning for People, Mumford and Ward note that people who may have worked together for years and developed close social ties because of this association will object to having the computer interfere with established relationships [Ref. 55].

Feelings of isolation because of the computer interface can also be heard in the form of complaints about computer nonresponsiveness. A Canadian Ombudsman Committee, in particular, has reviewed many cases in which citizens complain of the "computer" not replying to inquiries - especially when they concerned possible errors [Ref. 56]. This is not at all an uncommon problem, as probably most

people have experienced some degree of annoyance over an incorrect billing or unsolicited delivery to which, it seemed, the computer refused to acknowledge.

K. ANXIETY OVER "SOMETHING NEW"

One of the most straightforward reactions to a new computer system is the users' reluctance to change the current way of performing their work. Humans seem to have predisposed feelings about change per se - a sort of cautious and uncomfortable reluctance to accept the new [Ref. 57]. The introduction of a computer system can often be unsettling and disruptive to an organization. (Not to mention occasionally chaotic!) The potentially profound effects on the environment will thus understandably cause a certain amount of anxiety in those who are on the receiving side. In some people the anxiety is manifested as fear. As one manager indicated after the installation of a new system: "This has been a traumatic experience - computers scare the hell out of me!" [Ref. 58]

Mumford and Ward have observed that there are generally two types of anxiety associated with change [Ref. 59]. One type is a product of anticipation - "an emotional reaction due to a knowledge of the imminent introduction of a new technological process, and the individual's inability to

distinguish the desirability or undesirability of the consequences of this." They note that some people who cannot tolerate the anxiety and uncertainty just tend to worry about new events more than others. The other type of anxiety is found in the individual who is exposed to real psychological strain because of a change in job requirements and working conditions. Again, the authors comment that this type of change anxiety is more frequently encountered with certain personality types because individuals vary in their tolerances for certain types of stressful work.

L. PERSONIFICATION

With modern computers exhibiting many "human-like" capabilities, people sometimes feel that the system is in reality more than nuts and bolts - or bits and bytes. Almost anyone who has been around computers has observed others (if not themselves) reacting to the machine as if it were another person. Scheibe and Erwin [Ref. 60] and others have studied this phenomenon and have described some interesting human behavior when people interact with computers. Emotional outbursts directed toward the computer are not at all uncommon, nor is speaking in terms of the "whims and moods" of the computer [Ref. 61]. In Scheibe and Erwin's experiment, for example, the researchers found

frequent reference to the computer as "he" or "that guy." And while having subjects play computer games, they found them making frequent verbalizations (exclamations and commentary) toward the computer, often laced with profanity over being beaten by a computer game [Ref. 62].

M. PRECONCEIVED IDEAS AND PHILOSOPHICAL OBJECTIONS

Many people who have never dealt directly with a computer still have very definite ideas about its use and effects [Ref. 63]. These preconceived notions are often brought about by anti-computer propaganda in newspapers, television, literature or movies. When computers are depicted as master minds taking over control of their human designers or performing some such "evil" deed, it's no wonder that a certain amount of fear or suspicion develops - whether consciously or unconsciously - in the minds of those who have never met the terrible beast.

Apprehension over dealing with "computer people" may similarly evolve. Popular notions of the compulsive programmer, such as is described by Weizenbaum [Ref. 64] below can understandably prejudice new computer users who must interact with them:

> "Wherever computer centers have become established ... bright young men of disheveled appearance, often with sunken glowing eyes, can be seen sitting at computer consoles, their arms tensed and waiting to fire their fingers, already poised to strike, at the buttons and keys on which their attention seems to be as riveted as

> a gambler's on the rolling dice ... They work until they nearly drop, twenty, thirty hours at a time ... Their rumpled clothes, their unwashed and unshaven faces, and their uncombed hair all testify that they are oblivious to their bodies and to the world in which they move. They exist, at least when so engaged, only through and for the computers.

Almost since the original introduction of computers into modern society, there have been those few people who express a sort of indignation over the mere suggestion that a machine could possibly exhibit any ability to carry on the process of thinking! Back in 1962 in an article entitled "Attitudes Toward Intelligent Machines," [Ref. 65] Paul Armer refered to this as a type of "rivalry" between man and machine. He observed that there may be a strong personal factor in such attitudes, postulating that if man concedes that computers can exhibit intelligence, that is to admit "that man has a rival in an area previously held to be within the sole province of man." Although it is tempting to indulge in an "armchair evaluation" of the frailties of a personality threatened by the so-called intellect of a product of man, the problem remains that the feelings are real and consequently may result in isolated cases of system rejection based solely on a philosophical objection.

IV. INTEGRAL PERSPECTIVES

A. ATTITUDES AND BEHAVIOR

So what if some people don't *like* computers ... or are intimidated by the computer staff ... or feel automated systems are taking over the world? So what, as long as they keep doing their jobs, who cares if they're not happy or self-fulfilled? Fortunately, the above probably does not represent the views of most intelligent people, and for good cause, since attitudes *do*, to varying degrees, influence behavior. The precise relationship of attitudes to behavior is a subject well beyond the scope of this thesis. However, a brief examination is pertinent to the present context.

As Guthrie notes in "Attitudes of the User-Managers Towards Management Information Systems" [Ref. 66], the relationship between attitudes and behavior can be quite complex and not always obvious. As one would expect, some attitudes have considerably more influence on behavior than others, and sometimes behavior may even precede rather than follow attitude formulation. Additionally, attitudes may be formed either *rationally* (i.e., through logic and experience) or *irrationally* (i.e., through prejudice and speculation).

In Guthrie's study, he observed that people's behavior toward management information systems was not completely determined by the attitudes they held. For example, he noted that a person may still participate actively in the design of a MIS project, despite very negative attitudes. He explained that this may occur if, for example, the person's superior demands active participation and holds that person accountable for the success of the project. So, one may assume that negative attitudes among users does not necessarily predict disaster for a computer project.

Although the relationship between attitudes and behavior is not always clear, it is nevertheless valid to be concerned with negative attitudes because they are likely to have, at least, some impact on how well computer systems will be accepted and utilized. Thus, it logically follows that a tool designed to measure attitudes towards computers would be very useful in initial determination of people's disposition towards automation. Unfortunately, attitudes are not very easy to measure, because:

> "Subjects often do not consciously know their attitudes, are ambivalent, or are inclined to respond in socially acceptable terms, rather than reveal true feelings. Consequently, various artificial constructs and devices are used, or indirect responses (from which attitudes can be inferred) are obtained." [Ref. 67]

Still, researchers continue to direct their efforts toward

obtaining, as accurately as possible, measurements of attitudes.

One such tool that has recently been developed is the Defense Mechanism Inventory (DMI). This is an attitude test in the form of a questionnaire which measures include: [Ref. 68]

(1) aggression towards MIS and/or designer,
(2) projection of user mistakes to the system,
(3) repression of MIS mistrust,
(4) masochism which would rarely, if ever, apply to this context, and
(5) denial of the existence of the MIS and thus avoiding the system.

It is believed that by knowing the extent of these "ego defenses," the systems analyst can take appropriate actions to minimize their effect.

B. CHANGE MANAGEMENT

In many respects, the successful introduction of a computer based system into an organization is a matter of <u>good</u> change management. Much has been written to date on how to ease the potential trauma of any type of change within an organization, and many of the basic concepts are directly applicable to computerization. Without delving too deeply into the very broad subject of change management, a few relevant points will be made concerning the promotion of positive attitudes in a computer installation or modification effort.

When organizations do decide to install new systems or enhance old ones, the change should be well planned and executed in order to help pave the way for user acceptance. As one would expect, studies have shown that abortive attempts will have definite negative impacts on the system users, whereas smooth and successful system implementation tends tc foster positive attitudes among the users [Ref. 69]. A simple concept, but very important to adhere to if the change effort is to get off to a good start.

In "The Human Problems of Computer Introduction" [Ref. 70], Mumford et al insist that computer systems can be more effectively planned, designed and implemented if the social environments in which they are to be introduced are considered and if the attitudes and needs of the staff affected by them are examined. Again, another simple - but crucial - consideration. They propose that a thorough diagnosis of the social system must preceed the development of planning strategies. It should include a diagnosis of the stability of the pre-change system, an examination of people's attitudes (both to change in general and to the change that is being proposed), and a look at the extent to which groups and individuals show flexibility and rigidity in attitudes and behavior when presented with change.

Further, they believe that how groups and individuals perceive their own ability to influence the situation will affect the planning and implementation of the change. Once the social system has been evaluated (using various tools and/or methodologies), group profiles can be constructed to assist in the planning strategy. As an example, if a group of individuals is identified as having positive attitudes towards the proposed change, they should respond well to strategies allowing them maximum participation in the system planning, whereas more negative individuals might require a different strategy [Ref. 71].

C. ECONOMIC CONSIDERATIONS

Economically, practically and idealistically it would certainly be nice if there was one standard set of solutions to all human-computer interface problems. Regrettably, such is not the case. Some of the summarized findings of the famous Hawthorne Experiments at Western Electric Company (1927-1932) provide the essence of why we do not have easy solutions to the problem, and why 'packaged' computer programs can do little more than present canned solutions to problems: [Ref. 72]

* There is no 'one best way' of doing work; the best way is frequently situational.
* Human and group motivation are prime variables for improving operations.
* People are not only 'economic-rational man' - but even more important, people are 'emotional-irrational man.'
* Workers are individualistic, having subtle differences in attitudes, needs and behavior. Formal and informal human relationships are critical factors influencing whether or not the organization will attain its goals.

Numerous cases of economic disasters may be found because elements of human factors were neglected in a system design or implementation. In "Turning Reluctant Users on to Change" [Ref. 73], Lasden cites some of the costly consequences that can occur when people are not happy with a computer system. For example, there was a major bank that suffered a 50 percent terminal downtime rate - primarily because of uncooperative users; a large retail store that encountered union wrath when computer-linked cash registers were introduced without before-hand discussion with union members; and a big-city mayor whose election defeat was attributed, in part, to an endorsement of an ill-fated MIS project. Such examples of failed computing projects are so numerous, in fact, that some authors such as Robert Glass [Ref. 74] have chosen to write entire books on the subject, humorously and poignantly detailing technical and social flaws that cost government and private organizations

billions of dollars over the years. Obviously, computer systems are not only expensive to develop and install, but can financially destroy an organization if they perform poorly.

Often times difficult decisions as to whether or not to automate systems and functions must be made. As McCormick notes in Human Factors in Engineering and Design, the process of allocating certain functions to human beings and others to physical components is sometimes "virtually predetermined by certain manifest considerations, such as obvious superiority of one over the other or economic considerations." [Ref. 75] Some writers are quick to specify the areas in which man or computer are (seemingly) more adept. For example, in "The Evolution of Man-Computer Symbiosis," Testa observes that man is uniquely suited to set goals, formulate hypotheses, develop models, define criteria and evaluate results, whereas the computer can be effectively used to convert hypotheses into models for testing, perform simulations, and display results [Ref. 76]. However, the difficulty arises with the rather large range of functions that are within both the reasonable capabilities of man and machine. In Managing the Systems Development Process, the authors stress the importance of

recognizing the "emotional environment" (i.e., the human factors issues) when considering new systems for implementation in organizations [Ref. 77]. In extreme cases they note that projects which are "technically" feasible still may not be "emotionally" feasible because of political or re-education requirements. Unfortunately, there are no clear-cut guidelines for determining the degree to which an application should be automated, but as McCormick recommends, the strategy for allocating functions should be directed "in such a manner as to enhance the operation of the system as a whole, and toward the creation of jobs that are interesting, motivating, and challenging to the human operator." [Ref. 78]

Common sense - or just plain good business sense - must play a part in considering the many aspects and ramifications of automated processes. For example, in describing a case of "computer harassment," Sterling and Laudon [Ref. 79] recounted cases in which major credit companies in Canada were shown to have allowed too great a time delay between producing billing statements and mailing them - a problem which resulted in customers unjustly being charged interest because they did not have sufficient time to forward their payments. Although part of the excessive

time lag in receiving bills was attributed to postal delays, the point was well made that, while it was totally within the computers' capability to process large numbers of transactions daily, a terrible bottleneck occurred in the mechanical operations of stuffing bills into envelopes and mailing them out. As a consequence, many customers felt harassed by the system.* The credit companies apparently neglected to address a very important aspect of their total billing system, and as a result angered many customers. Probably some of those customers will blame the computers rather than see the problem in its total administrative perspective, and probably some will take their business elsewhere - but in any event, the net outcome is neither favorable toward the companies guilty of creating the problem nor toward the computer industry in general.

Practically speaking, it is inevitable that trade-offs will have to be made between engineering feasibility, human considerations, economic considerations, and other related factors. But, as McCormick advises, such trade-off decisions must be made on the basis of their relative impacts on the system objectives [Ref. 80]. By keeping the

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*And yet few issued formal complaints because of ignorance of whom to address the complaint to or because of a feeling of futility regarding the effectiveness of complaining.

system objectives in mind - which should include human objectives and technical objectives - perhaps decisions relating to computerization will be made more apparent.

D. SOCIAL PERSPECTIVE

The social impact of the computer is a subject that has stirred much debate in recent years. As was shown in the previous chapter, there is a type of fear that the computer represents an awesome potential for misuse and serves as a vehicle for the ultimate decline in basic human values. In "On the Impact of the Computer on Society" [Ref. 81], Weizenbaum expresses his concern that the policy makers have abdicated their decision-making responsibility to a computer they probably don't understand, while still pretending they are in charge. He fears the dehumanizing process that makes men who rely on machines become like machines, and the potential tragic impact on society that could result. The following excerpt reflects this concern:

> "...there is the psychological impact on individuals living in a society in which anonymous, hence irresponsible, forces formulate the large questions of the day and circumscribe the range of possible answers. It cannot be surprising that large numbers of perceptive individuals living in such a society experience a kind of impotence and fall victim to the mindless rage that often accompanies such experiences. But even worse, since computer-based knowledge systems become essentially immodifiable except in that they can grow, and since they induce dependence and cannot, after a certain threshold is crossed, be abandoned, there is an enormous risk that they will be passed from one generation to another, always growing..." [Ref. 82]

Many social commentaries reflect the view that management and computer specialists have a definite social responsibility for taking steps to safeguard against the human problems associated with computer technology. For example, in Ethical Conflicts in Computer Science and Technology, Parker insists that employees who introduce computer systems into their organizations in order to improve productivity "have a social responsibility to minimize the impact on replaced or displaced employees." [Ref. 83] However, at the other extreme, views such as the following can be found:

> "If jobs cannot be redesigned or enlarged so as to make them tolerable to existing staff - and this can often be done if a little thought is given to work procedures - then the only alternative is to select and train people who can tolerate the new working conditions." [Ref. 84]

One could easily find similar "pros" and "cons" on social responsibility issues that deal with most, if not all, of the attitude problems examined in Chapter III of this thesis.

In Computers: Planning for People, Mumford and Ward present a somewhat different, but thought provoking, concept in their call for social responsibility in light of continued technological progress:

> "...at present too many of our firms appear to confine their goals to things material and technological and to miss out on the human relations objectives. This in

> the long run can only cause trouble. Individuals, groups and society will start blocking innovation, and developments which could bring important advantages to us all will be held back or rejected because of the ineptitude of their introduction. Industrial leaders now have a tremendous responsibility to set their sights broadly and ensure that innovation is assisted by imaginitive goal definition which meet both the needs of its own employees and the ethical values of society." [Ref. 85]

Although their book was published over a decade ago, the general principles should theoretically still hold. The need for public acceptance of computer technology is certainly still a determinant of the industries' success and progress, and therefore the responsibility for meeting social as well as technical goals is still very applicable today.

V. RECOMMENDATIONS

As has been seen, many problems are associated with negative attitudes towards computers. Whether the attitudes are based on unfounded preconceived notions about computers "in general" or whether they are based on first-hand experience with a disastrous implementation, the net effect is still, to some degree, an aversion to automation. There are no clear-cut, easy answers to all the problems discussed so far, nor will generalized solutions translate to the many circumstances in which the attitude problems can exist. However, there are some very basic areas in which all persons concerned with a computer based system can act in order to encourage a more amiable and productive atmosphere.

The following sections describe some of the more important responsibilities of both individuals and groups of individuals - both from a local perspective (e.g., management, computer staff, users, and the project development team) and a social perspective (e.g., educational institutions, professional computer societies, and behavioral scientists). While all role responsibilities described are certainly not absolute and there is admittedly much overlap and interdependence involved with accomplishing

the intended goals of each, an attempt has been made to focus on the major contributions each individual or collective group has the potential for making.

A. ROLE OF MANAGEMENT

During recent years automation has become extremely attractive to all types of organizations for obvious economic reasons. It has been credited with "revolutionizing the management of most, if not all, systems by which goods and services are produced or information is accumulated." [Ref. 86] Furthermore, large scale computing systems have, in many ways, served to shape the way in which organizations have come to interact with individuals [Ref. 87]. However, as has been examined in this thesis, computerization unfortunately seems to bring with it continual tension between automation and individuality - especially in person-centered organizations [Ref. 88]. To help ease these conflicts, mid and upper level managers of organizations have an especially important responsibility to establish and maintain an environment that will encourage user acceptance of new computer systems and hopefully promote harmonious operations throughout the organization. Some of the ways in which management might serve to ease the potential individual (and consequently organizational)

trauma resulting from human-computer interface problems are presented in this section.

Because the mid-managers' role is deemed so critical in the design, conversion, and operation of an MIS, they are an obvious target group for attitude improvement efforts. In "Attitudes of the User-Managers Towards Management Information Systems," [Ref. 89] Guthrie expresses the view that middle managers are most heavily impacted by the introduction of a management information system, and stresses the importance of finding user-middle-managers who are willing to make an intensive and sincere effort toward dealing with the many problems and demands that tend to plague the design and implementation phases of a system development process. The author concludes with the recommendation that, while it is possible to impose MIS on a negative group of middle managers and try later to positively shift their attitudes, this type of coercive strategy is "doing it the hard way." Instead, it would seem that organizations contemplating MIS development would do much better to consider measuring their middle managers attitudes before starting the project and attempt to foster positive attitudes from the start.

Using the computer to improve rather than degrade working conditions is another area in which management can look for correcting or avoiding problems brought about by employee aversion to automation. It has long been recognized that a major cause of worker dissatisfaction is jobs that have been robbed of their meaning [Ref. 90]. New personnel policies may need to be established and jobs may need to be redesigned around the new computer system [Ref. 91]. As one example, new information technology offers a potential for providing increased autonomy among groups of workers [Ref. 92]. A team concept can be employed in many situations, creating intimate workshop units with their own discretionary powers and their own areas of responsibility. Workers previously relegated to menial tasks as part of a minor cog in a big machine can - through the aid of modern computer technology - be given work that is viewed as more meaningful and satisfying.

Management needs also to pay close attention to the psychological aspects of the new technology on the older and more experienced workers. As was discussed earlier, the fear - and reality - of obsolescence must be addressed. Gotlieb and Borodin [Ref. 93] suggest several improved management practices that can be implemented to more fully

utilize the talents of older workers and minimize the discrimination against them. Included among their recommendations are: the need to restructure salary practices that automatically discriminate against older workers; the need to distribute new and challenging projects as much as possible among all age groups; and the need to provide or encourage continuing education to gain the knowledge and skills required for a job.

Formal user support in all computer matters seems essential to foster positive attitudes over time. Proper initial training on the equipment is certainly a first step toward avoiding needless frustration over an inability to properly operate equipment, but more continuing attention is also required. A study of clerks whose work was centered around interaction with a computer found a common need expressed for more formal support in their daily computer operations. In addition to requiring help with operational matters, they indicated a desire to understand how the computer worked, the contribution they made in their work, and how it related to the functioning of the whole system [Ref. 94]. As one possible solution, it has been found that user "liaison" or "support" teams provide a good interface between the user and the technical operations of the system.

Encouraging and providing for active user involvement in the systems development process is another area in which management can take positive action toward fostering user acceptance. Much of the pre-change anxiety felt by employees is normally overcome as the impact of the new system becomes clearer, and good communication with the staff is especially important in helping to ease any doubts about the change [Ref. 95]. As London [Ref. 96] points out, however, it is extremely important that honest communications are carried on. He sharply criticizes the "pseudo-participation" encouraged by some organizations in which the users are led to believe their ideas are being seriously considered in the system development process - but in reality they are ignored. He further observes that not all companies are able to sustain the deception, and when the staff discovers that only lip service has been paid to their views and that their suggestions are not truly wanted or evaluated, they feel they have been victims of an insidious sales campaign and experience considerable hostility and feelings of rejection. Further, such tactics call the validity of the system into question. So, it is not adequate to recommend that organizations seek user involvement...they must also be sincere about it!

In line with the concept of user involvement, a comment needs to be made with repect to supervisory and management involvement. It is well known that supervisors' attitudes toward change can evoke positive or negative attitudes in their staff [Ref. 97]. If they are not convinced that the automated system is beneficial, they are most likely to pass this view on to their staff - thereby contributing to further anxiety and opposition. It would therefore seem wise for an organization to pay special attention to fostering positive attitudes in their supervisory and mid-level management personnel so that they will, in turn, reflect the desired enthusiasm to their subordinates.

Part of the responsibility in developing new computer systems must be an ability to also know when <u>not</u> to build them. As was discussed earlier, the emotional environment must allow for the automation of functions currently performed by employees. An examination of these human factors considerations should be directed by management as an essential part of the system feasibilty study. This allows recognition of potential problem areas in time to be effectively dealt with or to permit termination of further system consideration.

Of course, all the "right" techniques to establish people-oriented computer systems are most likely wasted efforts if the computers and users are to be housed in organizations that otherwise neglect employee satisfaction. Guthrie [Ref. 98] and others have found that user attitudes vary significantly among people in different organizations, a finding which strongly indicates that the organizational environment is a key factor in attitude formation. This finding certainly implies a need for management to critically examine its total environment, and make changes as necessary. As one writer states, "If there can be no 'person-centered computer technology' without person-centered organizations, then perhaps we should focus on deep institutional changes." [Ref. 99]

By understanding the underlying psychological aspects of the man-machine interface (or confrontation, as the case may be!), managers may help to avert some of the potential problems in this critical area. Management may also find it necessary to make anywhere from minor adjustments to dramatic changes in the organization in order to ease the psychological stress induced by newly installed automation. Supporting this view in Psychological Principles in System Development [Ref. 100], Gagne insists that new systems

demand new managerial insights and methods, and that psychology can provide the source of such methods. He emphasizes that the practical outcomes of employing psychological methods and principles will be better system performance sooner and at a lower cost - both in terms of people and the systems they use. Additionally, both the employee and the organization are served by job enrichment programs that enhance the meaningfullness of a job, because the result should be improved productivity via better employee motivation. So, in the long run, it should be found that the organization as a whole is one of the major benefactors of moves to humanize the computer interface.

B. ROLE OF THE COMPUTER STAFF

To lump all data processing professionals into one catagory collectively called "computer staff" may seem a little simple-minded or excessively broad in scope, but for the sake of this presentation it serves the purpose of generalizing certain responsibilities and assigning them to one major, identifiable group of people. Certainly different responsibilities can be associated with specific functional areas in the computer professions - there is no question that a system analyst will have more influence on the overall design of a system than say, a programmer. But

the programmer can also play an important role in how the human interface of a system is coded - and consequently how "friendly" it appears to the user - so the role of all computer people responsible for the design and implementation of a system will be considered together in this section (with specific references made to job titles where appropriate).

Perhaps the most striking area to address first is the all too apparent need for computer professionals (and especially system analysts) to develop more of a "human" or management orientation to complement their technical expertise. This applies, to varying degrees, to most all levels of the professional hierarchy. As Mumford and Ward [Ref. 101] have observed, those persons being groomed for computer management should not be allowed to remain locked in their specialist worlds. They should be trained in management, sociology and psychology. Without an ability to "convince" or to take account of "human relations" needs, the authors feel a computer manager can greatly inhibit the acceptance of computer systems in an organization.

Unfortunately, the career path in most organizations for computer professionals is typically from programmer to system analyst, a transition which can occur very quickly

because of the tremendous imbalance of supply and demand for systems professionals [Ref. 102]. Without encountering the myriad of "people problems" during their time as programmers, the many complexities of the human element involved in the system development process is understandably a puzzle to the neophyte analysts or system managers. Some of the areas in which it has been recommended [Ref. 103] that computer professionals should focus their efforts toward developing non-technical skills include: (1) teaching skills - developing an ability to educate users as to what computers can and cannot do, without excessive use of technical jargon; (2) interviewing skills - to improve understanding between user and analyst concerning what is actually desired in a system; (3) effective presentation skills - for the system briefings that are often required; (4) negotiating ability - to help smooth conflicts between users and technicians in a constructive manner, and (5) an understanding of the many elements of change management.

In recommending steps toward producing more "humane" computer applications, one author offers an alternative to requiring humanistic-oriented training for the computer staff:

> "Either computer technicians should be required to receive more training in human engineering, psychology,

> and sociology ... or humanists (social scientists, psychologists, sociologists, human engineers, professional personnel staff, etc.) should become integral contributors on computer projects." [Ref. 104]

Thus, if (for whatever reason) the computer staff does not possess the necessary "humanistic" skills, they should at least recognize their shortcomings and arrange for the needed expertise to be obtained elsewhere.

Computer professionals at all levels must also develop an ability to deal directly and honestly with the people they serve. In "Management Misinformation Systems," [Ref. 105] Ackoff comments that designers sometimes have a tendency to keep managers ignorant of the details of systems operations in an attempt to keep them from becoming "frightened." Ironically, this well-intentioned protection scheme frequently results in leaving the users too afraid to fully utilize systems because they don't know enough about them! Somewhere a balance must be reached where the computer technician is able to convey all the information a user requires to effectively operate a system - without being "scared off" by overly detailed information that is irrelevant to proper system use.

As one means of "humanizing" the transition to computerized systems, analysts might apply the concepts of job enrichment in systems design. In The People Side of

Systems, London defines job enrichment to be "job design or job redesign in which the 'motivators' are brought into play to increase productivity and morale". [Ref. 106] Job design for computer systems would be concerned primarily with "defining the user's relationship with automated procedures, and with specifying the job content on the input data collection and output report usage procedures". By examining each job at the component task level, and asking such questions as [Ref. 107]:

1. What must it achieve?
2. Is it necessary?
3. Is it complete, meaningful, and satisfying?
4. Will new conditions be required?
5. Is it practically viable?
6. Is it required purely for the sake of the computer?
7. Will it require new skills and are they available?
8. Is the training feasible?
9. What is the expected/required quantity of work?
10. What is the expected/required quality of work?

the system designer can help to support a formal job enrichment program within an organization.

On the slightly more technical side, the software interface between the user and the physical devices of the computer is an easy target for both severe criticism and significant improvement. Whoever is responsible for the part of the program that directly interfaces with the user can make a world of difference in user satisfaction by simply employing techniques (perhaps spiced with a little psychological theory and common good sense) to make each

encounter with the computer as pleasant and productive as possible. Although it may be an over-worked term in recent years, "user friendly" nicely describes the product that is desired. And there are a multitude of techniques that can be employed to make a computer system interface as pleasant as possible. Obvious "niceties" include such things as providing understandable and instructive prompts; not insulting the user with degrading error messages; not allowing the program to "bomb" on every minor error; and not requiring excessive and unnecessary input from the user if it can at all be avoided.

However, there are also many slightly more subtle areas where significant improvements in the human interface might be made. Providing manual overrides or by-passes to systems in order to prevent feelings of anxiety and frustration at a loss of control is just one of many suggestions offered by London as a means to reduce user anxiety [Ref. 108]. Of course, producing a software interface that will please every user is not an easy task. For example, as one writer has observed, problems can result from the vast differences in user experience and capability - novices prefer instructional assistance from the computer and experienced users prefer abbreviated commands [Ref. 109]. But the

resourceful programmer, in taking account of such variances, should (within reason) be able to produce a flexible system that encompasses different modes of operation for different skill levels and individual preferences. The end result should make the extra programming effort worthwhile. As one author expresses:

> "To the extent that we create computer systems which are friendly, responsive and forgiving we can help support distinct aspects of psychological success ... we can shift more of the burden for precision onto our computers and leave the users less tense and frustrated to attend to other work." [Ref. 110]

Really "digging in" to an organization - its people, objectives, operations, and of course its information needs is essential in a system design effort. The system analyst should not be contented to evaluate just what is <u>supposed</u> to happen in an organization, but must look at what <u>actually</u> happens [Ref. 111]. The two often do not agree. However, informal practices and behavior can be an integral part of an organization's operation, and therefore must be considered in designing an automated system to unobtrusively fit into the existing structure or provide for an improved, person-centered operation. Additionally, as Argyris [Ref. 112] has prescribed, the system designer must focus on all aspects of the functional <u>and</u> dysfunctional activities of an organization - acknowledging the relevant formal <u>and</u>

informal activities - so that all factors relevant to solving the problem at hand are considered.

Although this thesis has focused on the interface problems between generally non-technical users and the computer, it should be recognized that even though they are less negative in their orientation toward computers than the general public, "computer people" too have their own attitude problems [Ref. 113]. It would therefore be unfair to place the burden of helping to convey positive attitudes toward computers on the shoulders of computer professionals without recognizing that they are also human and subject to many of the same influences as users. Consequently, in helping to educate users and employ humanistically oriented procedures in all aspects of their work, computer professionals should assume the added responsibility of dealing with their own feelings and trying not to let them negatively influence the product of their work or their interactions with the users they serve.

Designing systems that, in addition to performing their intended functional purpose, also keep people happy in their work is not a simple matter. As Kling has observed in an article entitled "Towards a Person-Centered Computer Technology," in most system designs a person is regarded as

a rational information processor whose only requirement is minimal response time from the system. He further observes that:

> "We have few means to deal with a person who may seek productive, satisfying work that makes coherent sense, challenges his talents, and fosters a personal sense of competence. Without a rich image of a person that can be incorporated into system designs and be given a central role on par with rapid development, elegance, and efficiency, we are unlikely to see particularly humane computer systems." [Ref. 114]

Certainly common sense must temper cries for computer systems that are expected to do everything but tie one's shoes. Computer professionals cannot be experts in the behavioral sciences as well as their own very technical field. What is needed, however, is for computer professionals to exhibit more of an appreciation of and consideration for the human element in the man-machine interface.

C. ROLE OF THE PROJECT DEVELOPMENT TEAM

A project "team," "group," or "committee" has a very central role in insuring the implementation or enhancement of a computer system goes well. Much of the current literature points to the need for a project team - consisting of representatives from the user community, management, and the computer staff - to manage or direct the implementation of any computer information system. As the

focal point of control for the system, the project development team can directly serve to promote a good human-computer interface in many ways.

The importance of properly training users to operate a new automated system cannot be over emphasized. The authors of Managing The Systems Development Process highlight some of the important human issues of a good training program in the following:

> "...the training program should be constructed to both teach and sell. The project team all too often fails to adequately consider the anxiety that develops when an imminent change is not well understood. No one likes to change to the unknown. Thus the major emphasis at the beginning of the training sessions and throughout the program should be to sell the concepts and positive aspects of the new system. Users will emphasize the negative side - the extra work required for conversion, error correction, or batch control. They need to be sold and reminded of the positive side and of the expected benefits to the whole organization. Once they understand the system and their role and responsibility, they should begin to accept ownership of the new system." [Ref. 115]

An understanding and patient hand from the trainers is also a positive step during initial system training. As one consultant has explained, some people feel a general sense of awkwardness or discomfort around terminals, probably because they have never been around any type of computer system before. He recommends that in order to help overcome this discomfort, the user should be psychologically prepared by a reassuring, friendly instructor [Ref. 116].

The project team should similarly encourage the users who will actually be operating the new system to participate in the systems testing [Ref. 117]. This close involvement provides an excellent opportunity to build the users' confidence in the evolving system. Hopefully this confidence will carry over into later phases of system implementation and operation and, as the authors note, will boost the "spirit of cooperation during the inevitable rough spots" that are to follow.

In order to sustain a positive user attitude after an automated system has been put into operation, the project development team (or responsible concern) should, as Schneiderman [Ref. 118] appropriately terms it, "nurture" the user community. One way to accomplish this is to encourage an active user community. Schneiderman recommends such methods as providing onsite or telephone consultants to offer immediate aid when difficulties arise and establishing an online 'gripe' facility or suggestion box to give the users a feeling that they can provide useful inputs and additionally have an avenue to vent their anger over unsatisfactory system components. Of course, in order not to defeat the intended purpose, the system maintenance staff must provide timely responses to user suggestions or

inquiries. In addition to fostering positive user attitudes toward the computer system, an added side benefit may be that the users will actually provide some viable suggestions for system improvement!

Another positive step is to monitor user satisfaction by periodically querying users to determine attitudes. The use of interviews and/or questionnaires are two ways in which users feelings toward a system may be assessed [Ref. 119]. Although, as Schneiderman warns, subjective questions can be misleading, they still provide some indication of how the user feels toward the system.

D. ROLE OF THE USER

Even with the dedicated efforts of all the other "players" so far mentioned, there still remain those areas where only the individual users can effectively serve to improve system interfaces.

Becoming actively involved in the system development process from the very start of a project is certainly one major way in which users can play a valuable role. By providing clear, concise, and realistic input to the original system specifications, the users will establish themselves as a credible and concerned force while at the same time help to insure the development of a system that

truly reflects their requirements. Representation and active participation on the project team is therefore essential to a successful development effort.*

Forming user groups - whether formally or informally - is another way in which concerned system users can help to promote their cause. Such groups not only keep interest "alive" among users, but also provide a valuable forum for users to share problems and solutions to problems among themselves. In large user communities, the author of Software Psychology [Ref. 121] observes that user newsletters might even be appropriate. The main idea is to promote the open interchange of ideas and problems. Spontaneously started groups can also be very helpful. In one decision support system (DSS) implementation study [Ref. 122], it was found that initial unreliability of the system discouraged many from using it. However, a few enthusiastic users got together and lead sessions for users (who were already trained in the mechanics of the system) in order to show them how to mesh their new DSS capability into their day-to-day decisionmaking requirements. By exerting a little peer pressure, the enthusiastic users were able to

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*Unfortunately, as Biggs et al [Ref. 120] have observed, representation from the user organization is one of the "missing links" on most projects.

share their positive interface experiences and help to generate acceptance and new ideas from the more reluctant members.

As computers become more widespread in society, and begin to record more and more quantitative information about individuals, increased attention is focused on the overall quality of computer based systems. In the sense that anyone who must interact with an organization that utilizes computers in their operations may loosely be regarded as a user, there is a sort of shared responsibility among all citizens to keep automation "in line." Questions of appropriateness, fairness, efficiency and many others need to be asked by concerned individuals so that abuses can be minimized. Unfortunately, as one observer has noted, although there is a great range of views about the effects of computer technology on mankind and varying opinions on what specifically the real problems are, on the whole there is a general sense of pessimism [Ref. 123]. Hopefully more positive attitudes will emerge if people become more actively concerned, and as a result, come to feel less intimidated or frustrated by daily interactions with poorly designed or operated systems.

E. ROLE OF EDUCATIONAL INSTITUTIONS

Schools and universities have the potential to play a very important role in properly familiarizing future computer system users with the technology with which they will become involved. A little bit of knowledge can go a long way in alleviating unfounded fears and anxieties. At an International Conference on Human Choice and Computers, the need for education as a means of preparing the general public for sensible use of computers in the future was widely discussed [Ref. 124]. All agreed that schools should provide instruction in the use and potential capabilities of computers because computer literacy will be essential for "informed human choice" in the future.* In order to take full advantage of the numerous projected computer-associated benefits of the future (e.g., program libraries, data registers and archives, freely available terminal access, public data communications systems, etc.) they maintained that people will require, at least, minimal knowledge.

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*This view is somewhat contradicted by a 1970 ACM survey which found a substantial number of computer people expressing unfavorable attitudes toward computerization. The conclusions of the researchers were that unfavorable attitudes toward computerization in our society are inevitable and that computer literacy (i.e., increased knowledge and experience with computers) does not in any way guarantee favorable attitudes toward computers [Ref. 125].

The definition of "proper" computer education - while certainly subjective in nature - seems to be an especially important concern. In this regard an interesting observation was made by Harold Sackman [Ref. 126] in an article entitled "Computers and Social Options." He has shown that computer courses in universities often serve to "turn off" students, and that these negative attitudes formed in school will carry over into professional careers. His criticism stems from the fact that most people who become at all involved with computers will be users, not programmers, and yet the schools too often succeed in only discouraging the students by requiring laborious coding exercises and extensive debugging to produce programs for class assignments [Ref. 127]. Perhaps, rather than frustrating students with elementary programming experience that may never be utilized in future professions, the universities should establish generalized survey courses for data processing. Such courses could focus on practical aspects such as the products of current technology, programming logic (in theory), and computer capabilities that are oriented toward a non-technical user's perspective. This is not an advocation of eliminating technical computer courses - they certainly should be available to all

interested students. However, an alternative should be offered that provides a more relevant curriculum to those students who want only to become acquainted with this fast-growing technology.

In order to properly impart the knowledge to students, the "knowledge" must, of course, first be available. It therefore follows that research is a major area in which educational institutions can contribute toward gaining more insight and providing definitive solutions to the many human-computer interface problems presented in this thesis. Certainly many of the subject areas are not easy to study in controlled laboratory settings, but meaningful field research and case studies conducted through schools could, at least, increase the current body of knowledge and stimulate further interest in the subject of man-computer interface issues.

F. ROLE OF PROFESSIONAL COMPUTER SOCIETIES

A multitude of professional societies now exist whose charters are based on some aspect of computer technology or the management of data processing systems. So what better place is there to monitor the progress and address the concerns of human-computer interface issues? By encouraging research and establishing guidelines for facilitating system

implementations that consider human issues, professional societies can play an invaluable role in "curing the ills" of our current state of affairs.

The first major international conference on the human aspects of computer systems was the Conference of Human Choice and Computers, held in Vienna, Austria, in 1974. Among its aims was to enable trade unionists, computer technologists, and social scientists to enter into meaningful discussion with one another. At the conclusion of the conference, the participants called for the development of a "Computer Bill of Rights" which would be a law, code of practice, or international agreement established to encourage the benefits of computers, while at the same time protect the individual from any misuse of computer based information system [Ref. 128].

Computer societies also have the important responsibility of promoting professionalism and social responsibility in the field of computer technology. The Association for Computing Machinery (ACM) has taken several steps in this regard. They have developed a "Code of Professional Conduct" to set forth general principles, professeonal ideals, and mandatory rules applicable to each ACM member. Furthermore, having become concerned over the

difficulties many people have encountered with computerized billing systems and the like, the ACM has encouraged local chapters to set up ombudsmen to help people experiencing trouble due to mistakes made through the use of computers [Ref. 129]. Additionally, along with the Canadian Information Processing Society (CIPS), the ACM has proposed a set of guidelines for humanizing information systems [Ref. 130]. Actions such as these can go a long way in improving internal integrity and in promoting good will toward the computer professions and computing itself.

G. ROLE OF BEHAVIORAL SCIENTISTS

Because the need to understand human personality, emotions, cognitive styles and social interactions is so very basic to the successful development and implementation of a computer system, it follows that behavioral scientists certainly must assume an essential role in the furthering of our current knowledge. Continued and expanded studies are required in a host of areas.

Researchers have already provided us with valuable information relating to the psychology of individual differences in problem solving and cognitive styles impact on the facility of use of computer-based decision aids [Ref. 131]. Additionally, as was suggested in section IV-A,

another important area of study concerns the development of new testing techniques to more accurately assess and measure user attributes related to computer acceptance. Although preliminary work has already begun in this and other areas, new areas of study should be developing almost daily to keep up with the astounding speed of advances in computer technology.

Equally as important as the role of behavioral scientist as researcher is the role of behavioral scientist as designer and implementor. The engineering psychologist, in particular, can play a vital part in the successful interface of almost any automated system. As Chapanis notes in Man-Machine Engineering [Ref. 132], the engineering psychologist must consider the whole content of normal human experimental psychology in his or her work. For example, knowledge of the sensitivity of the eye is required for constructing effective visual signal systems, information about the ear is required in selecting and designing auditory signals, knowledge of the human memory span is important in writing program interfaces, and even the ways in which people work, become tired, and sleep can sometimes prove to be important in designing computer systems and work environments to suit the user.

H. SHARED RESPONSIBILITIES

The responsibility for improving the quality of man-machine interfaces, and hopefully in doing so alleviating many of the problems discussed in this thesis, is to a large extent a highly interdependent arrangement. No one group working in isolation could possibly accomplish their goals without the support and cooperation of others. For example, without concerned user involvement and active management support, the computer staff would have great difficulty in designing a system to truly meet the users' needs. It may sound trite, but the key to the success of the measures recommended in this chapter is definitely "teamwork." There are, additionally, certain areas that are so intrinsically shared responsibilities that they have been left for this final section.

One author has stated that responsible people in the world of computing want to avoid creating a "gold-fish bowl society" by ensuring that the massive potential of computers is harnessed for the benefit of society rather than being used indiscriminately [Ref. 133]. The area of individual invasion of privacy via computer overlaps several areas of responsibility. From the organization that wants to collect

what might euphemistically be termed "inappropriate"* data to the unsuspecting citizen who releases the data to the aloof system designer who prescribes the software to manipulate and store the data - all are guilty of contributing (even if unknowingly) to an infraction of individual rights. Each person, group, or organization in any way involved with an automated system that requires personal data must take individual responsibility for questioning the appropriateness of the system and their role in contributing toward its continuation.

Viewed from an overall perspective, the design, implementation, and operation of an automated system is largely a shared responsibility. Although each phase of the system development has varying emphasis on different people or groups, the ultimate quality of the system depends on all individuals, organizations or institutions involved. Consequently, the entire system development process should in a very broad sense be seriously regarded as a collective responsibility.

Parker has stated that all persons involved in the computer systems development should:

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*An admittedly subjective term that is used in the present context to describe an act of data collection that is clearly not in the best interests of the individual or society as a whole.

> "...always consider human consequences ... to develop habits of addressing classes of human problems that are exemplified in particular cases, e.g., job loss, dehumanization of work, or physical danger." [Ref. 134]

The concept of promoting an awareness among people involved in the development process may well have successful results. Perhaps many human issues in computer systems of the past have been ignored solely because no one ever thought of addresing them.

An important danger for all concerned to guard against is the "lure" of over-automation. There must be an awareness and an ability to distinguish between those functions which should be automated and those which can be automated [Ref. 135]. Organizational management, system developers and users alike need to remain sensitive to the "appropriateness" of any proposed automated capability. For while many operations may technically lend themselves to computer applications, their net effect might be to degrade an element of human satisfaction that will ultimately serve to only "feed the fire" of dissatisfaction toward all automation.

The recognition of the inevitability of errors in the programs and the sometimes annoying problems associated with a newly automated system is essential for all concerned. Tolerance and tempered expectations are the key qualities.

Management must not expect immediate miracles from the system nor astronomic profits to be realized in the first weeks of operation. Neither should the system developers become impatient if users fail to comprehend the many intracacies of the system from the start. Perhaps most importantly, though, the user must be made aware that errors and discrepancies will occur, and their patience must be indulged while the "bugs" are ironed out. Biggs et al [Ref. 136] have also stressed the extreme importance of helping to build user confidence by issuing such preliminary warnings. They also add that to help minimize the "shock effect" that can take place if users encounter too many discrepancies during initial user system testing, programs should be tested as thoroughly as possible before releasing the system for use.

VI. CONCLUSIONS

The various attitude problems associated with computer based systems are clearly both pervasive and potentially troublesome if not dealt with directly. However, it must also be recognized that computer technology and information systems management are relatively new institutions in industry, and as such the types of problems encountered are certainly understandable and probably inevitable.

With the astounding advances made in recent years in micro-electronics and with the ever-growing computerized office equipment market, it is really no wonder that many people simply have not been able to adjust their work habits or achieve the required intellectual comprehension with corresponding speed. Negative attitudes are not necessarily permanent feelings, but more likely temporary expressions of frustration or anxiety. As with any new system, some problem areas merely require a combination of time and fine-tuning to work their way out. The fact that many of the interface problems have surfaced and have been dealt with successfully is evidence of a sincere concern for humanizing systems as much as possible.

There is still much to be learned about man-computer interaction. It has been observed [Ref. 137] that although the literature on human issues associated with computer technology is growing rapidly, it remains largely fragmented because different authors focus on different concerns. Each situation is to a large extent unique, but still must offer some similarities in attitude problems surrounding computerization. The collection of a more integrated body of knowledge and the development of viable, testable theories of man-computer interaction is clearly indicated.

Mankind has benefited greatly from computer technology - and the future most likely holds possibilities not even imaginable a few decades ago. The importance of overcoming negative attitudes and establishing a truly symbiotic relationship between people and computers, then, must continue to be addressed if the technology is to be encouraged in the future and thereby allowed to realize its full potential.

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